

TABLE 1-continued

Str. Pt. (° C.)	675	669	670	672	670	664	671	677	659
Ann. Pt. (° C.)	730	725	727	728	727	720	727	732	713
Soft. Pt. (° C.)	984	978	996	988	989	984	989	979	967
110 BHF (mg/cm ²)		0.16	0.3	0.39	0.18	0.17	0.19	0.19	0.23
Liq. Temp. (° C.)	1100	1140	1165	1160	1140	1150	1150	1150	1120
Liq. Visc. (p)	1.06E + 06	2.40E + 05	2.88E + 05	2.49E + 05	4.29E + 05	2.80E + 05	3.11E + 05	2.14E + 05	3.07E + 05
Melt. Temp. (° C.)	1655	1617	1682	1656	1668	1653	1656	1620	1611

	Composition Batched (mol %)	28	29	30	31	32	Comp Ex
	SiO ₂	70	70.4	69.8	71	72	67.6
	Al ₂ O ₃	10	10.2	10.6	9.9	9.33	11.4
	B ₂ O ₃	10	9.1	9	10	10	8.5
	MgO						1.3
	CaO	9	5.68	7.14	9.1	8.66	5.2
	SrO		4.55	3.42			1.3
	BaO						4.3
	As ₂ O ₃						0.4
	Sb ₂ O ₃	0.3	0.3	0.3	0.3	0.3	
	CeO ₂						
	Y ₂ O ₃						
	SnO ₂						
	Cl						
	RO/Al ₂ O ₃	0.90	1.00	1.00	0.92	0.93	1.03
	CTE (0-300° C., × 10 ⁻⁷ /° C.)	32.0	34.4	34.4	32.1	31.2	37.8
	Dens. (g/cm ³)	2.355	2.420	2.406	2.353	2.342	2.54
	Str. Pt. (° C.)	673	669	672	669	672	666
	Ann. Pt. (° C.)	731	727	729	726	730	721
	Soft. Pt. (° C.)	999	987	984	998	1012	975
	110 BHF (mg/cm ²)	0.18					0.2
	Liq. Temp. (° C.)	1130	1130	1135	1120	1125	1050
	Liq. Visc. (p)	5.99E + 05	5.67E + 05	4.38E + 05	8.46E + 05	8.79E + 05	2.97E + 06
	Melt. Temp. (° C.)	1670	1671	1657	1685	1703	1636

+T2 TABLE 1+HZ,1/64

!+TL,1 Composition? +TC,10 ? +TC,16 ? +TC,22 ? +TC,28 ? +TC,34 ? +TC,40 ? +TC,46 ? +TC,52

? +TC,58 ?

!Batched (mol %)? 1? 2? 3? 4? 5? 6? 7? 8? 9+TZ,1/64 ?

!SiO+HD 2? +TA 69.75? +TA 69.78? +TA 69.75? +TA 69.8? +TA 70.7 ? +TA 70.57? +TA 69.1?

+TA 70.85? +TA 69.1?

!Al+HD 2+L O+HD 3? 10.2? 10.2? 10.3? 10.3? 10? 9.77? 10.35? 9.5? 10.35?

!B+HD 2+L O+HD 3? 9.7? 9.7? 9.5? 9.5? 10? 9.95? 10.25? 10.1? 10.25?

!MgO? 0.8? 0.8? 0.8? 0.8? ? 0.12? 0.15? 1.25? 0.15?

!CaO? 7? 7? 8.5? 8.5? 9? 9.17? 9.8? 6.7? 9.3?

!SrO? 2.2? 2.2? 0.8? 0.8? ? ? ? 1.3? 0.5?

!BaO?

!As+HD 2+L O+HD 3? ? 0.3? ? 0.3? ? 0.4? 0.33? ? 0.33?

!Sb+HD 2+L O+HD 3? 0.3? ? 0.3? ? 0.3? ? ? 0.1?

!CeO+HD 2? ? ? ? ? ? ? ? 0.2?

!Y+HD 2+L O+HD 3?

!SnO+HD 2? 0.05? 0.02? 0.05? ? 0.05? 0.02? 0.02? ? 0.02?

!Cl? 0.2? 0? 0.2? ? 0.2? ? ? 0.2?

!RO/Al+HD 2+L O+HD 3? 0.98? 0.98? 0.98? 0.98? 0.90? 0.95? 0.96? 0.98? 0.96?

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!CTE (0+14 300+20 +0 C., +33 ? 32.7? 31.2? 31.9? 30.8? 30.5? 30.2? 31.5? 31.4? 32.2?
!10+HU +31 7+L /+20 +0 C.)?

!Dens. (g/cm+HU 3+L)? 2.416? 2.404? 2.394? 2.38? 2.37? 2.355? 2.375? 2.367? 2.377?

!Str. Pt (+20 +0 C.)? 672? 674? 673? 679? 671? 666? 673? 664? 671?

!Ann. Pt. (+20 +0 C.)? 727? 731? 729? 734? 728? 729? 729? 720? 727?

!Soft. Pt. (+20 +0 C.)? 984? 991? 991? 995? 1001? 1001? 976? 992? 983?

!110 BHF (mg/cm+HU 2+L)? 0.15? 0.14? 0.145? 0.135? 0.14? 0.15? 0.18? 0.27? 0.15?

!Liq. Temp. (+20 +0 C.)? 1125? 1120? 1120? 1125? 1150? 1135? 1115? 1140? 1095?

!Liq. Visc. (p)? +TC 5.04E +30 +0 05? +TC 7.06E +30 +0 05? +TC 6.34E +30 +0 05? +TC 6.30E
+30 +0 05? +TC 3.66E +30 +0 05? +TC 5.95E +30 +0 05? +TC 5.30E +30 +0 05? +TC 4.77E +30
+0 05? +TC 1.05E +30 +0 06?

!Melt. Temp. (+20 +0 C.)? +TA 1659? +TA 1668? +TA 1650? +TA 1659? +TA 1668? +TA 1680?
+TA 1635? +TA 1686? +TA 1649+TZ,1/64 ?

!+TL,1 Composition? +TC,10 ? +TC,16 ? +TC,22 ? +TC,28 ? +TC,34 ? +TC,40 ? +TC,46 ? +TC,52
? +TC,58 ?

!Batched (mol %)? 10? 11? 12? 13? 14? 15? 16? 17? 18+TZ,1/64 ?

!SiO+HD 2? +TA 69.65? +TA 68.75? +TA 69.1? +TA 68.8? +TA 69.33? +TA 69.65? +TA 70.05?
+TA 69.33? +TA 69.45?

!Al+HD 2+L O+HD 3? 10.1? 10.55? 10.2? 10.35? 10.55? 10.2? 9.9? 10.55? 11?

!B+HD 2+L O+HD 3? 10.25? 10.25? 10.55? 10.55? 9.97? 10.25? 10.25? 9.97? 9?

!MgO? 0.15? 0.15? 0.15? 0.15? 0.18? 0.15? 0.15? 0.18?

!CaO? 9.45? 9.9? 9.65? 9.8? 9.08? 8.85? 9.25? 9.58? 10?

!SrO? ? ? ? 0.5? 0.5?

!BaO?

!As+HD 2+L O+HD 3? 0.4? 0.4? 0.33? 0.33? 0.37? 0.4? 0.4? 0.37?

!Sb+HD 2+L O+HD 3? ? ? ? ? ? ? ? 0.3?

!CeO+HD 2? ? ?

!Y+HD 2+L O+HD 3?

!SnO+HD 2? 0.02? 0.02? 0.02? 0.02? 0.02? 0.02? 0.02? 0.02? 0.05?

!Cl? ? ? ? ? ? ? ? 0.2?

!RO/Al+HD 2+L O+HD 3? 0.95? 0.95? 0.96? 0.96? 0.93? 0.93? 0.95? 0.93? 0.91?

!CTE (0+14 300+20 +0 C., +33 ? 31.4? 31.8? 32? 31.8? 31.5? 30.9? 30.8? 31.4? 32?

!10+HU +31 7+L /+20 +0 C.)?

!Dens. (g/cm+HU 3+L)? 2.366? 2.371? 2.364? 2.366? 2.376? 2.369? 2.357? 2.366? 2.386?

!Str. Pt (+20 +0 C.)? 669? 674? 666? 667? 676? 671? 668? 674? 681?

!Ann. Pt. (+20 +0 C.)? 725? 729? 722? 723? 731? 728? 726? 730? 737?

!Soft. Pt. (+20 +0 C.)? 985? 986? 980? 980? 985? 987? 992? 987? 993?

!110 BHF (mg/cm+HU 2+L)? ? ? ? ? 0.12? 0.12?

!Liq. Temp. (+20 +0 C.)? 1090? 1100? 1090? 1115? 1095? 1100? 1100? 1120? 1150?
!Liq. Visc. (p)? +TC 1.23E +30 +0 06? +TC 9.19E +30 +0 05? +TC 1.07E +30 +0 06? +TC 5.74E
+30 +0 05? +TC 1.19E +30 +0 06? +TC 1.04E +30 +0 06? +TC 1.12E +30 +0 06? +TC 6.23E +30
+0 05? +TC 2.90E +30 +0 05?
!Melt Temp. (+20 +0 C.)? +TA 1654? +TA 1650? +TA 1642? +TA 1650? +TA 1651? +TA 1657? +TA
1674? +TA 1654? +TA 1642+TZ,1/64 ?
!+TL,1 Composition? +TC,10 ? +TC,16 ? +TC,22 ? +TC,28 ? +TC,34 ? +TC,40 ? +TC,46 ? +TC,52
? +TC,58 ?
!Batched (mol %)? 19? 20? 21? 22? 23? 24? 25? 26? 27+TZ,1/64 ?
!SiO+HD 2? +TA 69.33? +TA 68.3? +TA 70.45? +TA 70? +TA 70.4? +TA 70.1? +TA 70? +TA 68.3?
+TA 68?
!Al+HD 2+L O+HD 3? 10.55? 10.9? 9.85? 10.35? 10.05? 10? 10.23? 10.9? 10.5?
!B+HD 2+L O+HD 3? 9.97? 10.4? 9.55? 9.5? 9.69? 10.15? 9.75? 10.4? 11?
!MgO? 0.18? ? 1.1? 0.8? 0.82? 0.81? 0.8?
!CaO? 9.08? 9.1? 5.75? 8.5? 7.14? 7.11? 7? 9.1? 10.5?
!SrO? 0.5? 1? 2.9? 0.85? 1.89? 1.88? 2.22? 1.0?
!BaO?
!As+HD 2+L O+HD 3? ? ? 0.4? ? ? ? 0.3?
!Sb+HD 2+L O+HD 3? 0.37? 0.3? ? ? ? ? 0.3?
!CeO+HD 2? ? ? ? 0.2? 0.2? 0.2? 0.2?
!Y+HD 2+L O+HD 3?
!SnO+HD 2? 0.02? 0.05? ? ? ? ? 0.05?
!Cl? ? 0.2?
!RO/Al+HD 2+L O+HD 3? 0.93? 0.93? 0.99? 0.98? 0.98? 0.98? 0.98? 0.93? 1.00?
!CTE (0+14 300+20 +0 C., +33 ? 31.9? 34.8? 33.4? 32.8? 33.5? 32.9? 33.4? 34.5? 34.9?
!10+HU +31 7+L /+20 +0 C.)?
!Dens. (g/cm+HU 3+L)? 2.383? 2.403? 2.405? 2.378? 2.378? 2.374? 2.391? 2.392? 2.378?
!Str. Pt (+20 +0 C.)? 675? 669? 670? 672? 670? 664? 671? 677? 659?
!Ann. Pt. (+20 +0 C.)? 730? 725? 727? 728? 727? 720? 727? 732? 713?
!Soft. Pt. (+20 +0 C.)? 984? 978? 996? 988? 989? 984? 989? 979? 967?
!110 BHF (mg/cm+HU 2+L)? ? 0.16? 0.3? 0.39? 0.18? 0.17? 0.19? 0.19? 0.23?
!Liq. Temp. (+20 +0 C.)? 1100? 1140? 1165? 1160? 1140? 1150? 1150? 1150? 1120?
!Liq. Visc. (p)? +TC 1.06E +30 +0 06? +TC 2.40E +30 +0 05? +TC 2.88E +30 +0 05? +TC 2.49E
+30 +0 05? +TC 4.29E +30 +0 05? +TC 2.80E +30 +0 05? +TC 3.11E +30 +0 05? +TC 2.14E +30
+0 05? +TC 3.07E +30 +0 05?
!Melt. Temp. (+20 +0 C.)? +TA 1655? +TA 1617? +TA 1682? +TA 1656? +TA 1668? +TA 1653?
+TA 1656? +TA 1620? +TA 1611+TZ,1/64 ?
!+TL,19 Composition? +TC,28 ? +TC,34 ? +TC,40 ? +TC,46 ? +TC,52 ? +TC,58 ?

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!Batched (mol %)? 28? 29? 30? 31? 32? Comp Ex+TZ,1/64 ?
!SiO+HD 2? +TA 70? +TA 70.4? +TA 69.8? +TA 71? +TA 72? +TA 67.6?
!Al+HD 2+L O+HD 3? 10? 10.2? 10.6? 9.9? 9.33? 11.4?
!B+HD 2+L O+HD 3? 10? 9.1? 9? 10? 10? 8.5?
!MgO? ? ? ? ? 1.3?
!CaO? 9? 5.68? 7.14? 9.1? 8.66? 5.2?
!SrO? ? 4.55? 3.42? ? ? 1.3?
!BaO? ? ? ? ? 4.3?
!As+HD 2+L O+HD 3? ? ? ? ? 0.4?
!Sb+HD 2+L O+HD 3? 0.3? 0.3? 0.3? 0.3? 0.3?
!CeO+HD 2?
!Y+HD 2+L O+HD 3?
!SnO+HD 2?
!Cl?
!RO/Al+HD 2+L O+HD 3? 0.90? 1.00? 1.00? 0.92? 0.93? 1.03?
!CTE (0+14 300+20 +0 C., +33 ? 32.0? 34.4? 34.4? 32.1? 31.2? 37.8?
!10+HU +31 7+L /+20 +0 C.)?
!Dens. (g/cm+HU 3+L)? 2.355? 2.420? 2.406? 2.353? 2.342? 2.54?
!Str. Pt (+20 +0 C.)? 673? 669? 672? 669? 672? 666?
!Ann. Pt. (+20 +0 C.)? 731? 727? 729? 726? 730? 721?
!Soft. Pt. (+20 +0 C.)? 999? 987? 984? 998? 1012? 975?
!110 BHF (mg/cm+HU 2+L)? 0.18? ? ? ? 0.2?
!Liq. Temp. (+20 +0 C.)? 1130? 1130? 1135? 1120? 1125? 1050?
!Liq. Visc. (p)? +TC 5.99E +30 +0 05? +TC 5.67E +30 +0 05? +TC 4.38E +30 +0 05? +TC 8.46E
+30 +0 05? +TC 8.79E +30 +0 05? +TC 2.97E +30 +0 06?
!Melt. Temp. (+20 +0 C.)? +TA 1670? +TA 1671? +TA 1657? +TA 1685? +TA 1703? +TA
1636+TZ,1/64 ?
!+PS

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CWU Table Item #: 0111 (2 columns)

TABLE I

Composition Batched (mol %)	1	2	3	4	5	6	7	8	9
SiO ₂	69.75	69.78	69.75	69.8	70.7	70.57	69.1	70.85	69.1
Al ₂ O ₃	10.2	10.2	10.3	10.3	10	9.77	10.35	9.5	10.35
B ₂ O ₃	9.7	9.7	9.5	9.5	10	9.95	10.25	10.1	10.25
MgO	0.8	0.8	0.8	0.8		0.12	0.15	1.25	0.15
CaO	7	7	8.5	8.5	9	9.17	9.8	6.7	9.3
SrO	2.2	2.2	0.8	0.8				1.3	0.5
BaO									
As ₂ O ₃		0.3		0.3		0.4	0.33		0.33
Sb ₂ O ₃	0.3		0.3		0.3			0.1	
CeO ₂								0.2	
Y ₂ O ₃									
SnO ₂	0.05	0.02	0.05		0.05	0.02	0.02		0.02
Cl	0.2	0	0.2		0.2			0.2	
RO/Al ₂ O ₃	0.98	0.98	0.98	0.98	0.90	0.95	0.96	0.98	0.96
CTE (0-300° C., × 10 ⁻⁷ /° C.)	32.7	31.2	31.9	30.8	30.5	30.2	31.5	31.4	32.2
Dens. (g/cm ³)	2.416	2.404	2.394	2.38	2.37	2.355	2.375	2.367	2.377
Str. Pt (° C.)	672	674	673	679	671	666	673	664	671
Ann. Pt. (° C.)	727	731	729	734	728	729	729	720	727
Soft. Pt. (° C.)	984	991	991	995	1001	1001	976	992	983
110 BHF (mg/cm ²)	0.15	0.14	0.145	0.135	0.14	0.15	0.18	0.27	0.15
Liq. Temp. (° C.)	1125	1120	1120	1125	1150	1135	1115	1140	1095
Liq. Visc. (p)	5.04E + 05	7.06E + 05	6.34E + 05	6.30E + 05	3.66E + 05	5.95E + 05	5.30E + 05	4.77E + 05	1.05E + 06
Melt. Temp. (° C.)	1659	1668	1650	1659	1668	1680	1635	1686	1649
Composition Batched (mol %)	10	11	12	13	14	15	16	17	18
SiO ₂	69.65	68.75	69.1	68.8	69.33	69.65	70.05	69.33	69.45
Al ₂ O ₃	10.1	10.55	10.2	10.35	10.55	10.2	9.9	10.55	11
B ₂ O ₃	10.25	10.25	10.55	10.55	9.97	10.25	10.25	9.97	9
MgO	0.15	0.15	0.15	0.15	0.18	0.15	0.15	0.18	
CaO	9.45	9.9	9.65	9.8	9.08	8.85	9.25	9.58	10
SrO					0.5	0.5			
BaO									
As ₂ O ₃	0.4	0.4	0.33	0.33	0.37	0.4	0.4	0.37	
Sb ₂ O ₃									0.3
CeO ₂									
Y ₂ O ₃									
SnO ₂	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.05
Cl									0.2
RO/Al ₂ O ₃	0.95	0.95	0.96	0.96	0.93	0.93	0.95	0.93	0.91
CTE (0-300° C., × 10 ⁻⁷ /° C.)	31.4	31.8	32	31.8	31.5	30.9	30.8	31.4	32
Dens. (g/cm ³)	2.366	2.371	2.364	2.366	2.376	2.369	2.357	2.366	2.386
Str. Pt (° C.)	669	674	666	667	676	671	668	674	681
Ann. Pt. (° C.)	725	729	722	723	731	728	726	730	737
Soft. Pt. (° C.)	985	986	980	980	985	987	992	987	993
110 BHF (mg/cm ²)					0.12	0.12			
Liq. Temp. (° C.)	1090	1100	1090	1115	1095	1100	1100	1120	1150
Liq. Visc. (p)	1.23E + 06	9.19E + 05	1.07E + 06	5.74E + 05	1.19E + 06	1.04E + 06	1.12E + 06	6.23E + 05	2.90E + 05
Melt Temp. (° C.)	1654	1650	1642	1650	1651	1657	1674	1654	1642
Composition Batched (mol %)	19	20	21	22	23	24	25	26	27
SiO ₂	69.33	68.3	70.45	70	70.4	70.1	70	68.3	68
Al ₂ O ₃	10.55	10.9	9.85	10.35	10.05	10	10.23	10.9	10.5
B ₂ O ₃	9.97	10.4	9.55	9.5	9.69	10.15	9.75	10.4	11
MgO	0.18		1.1	0.8	0.82	0.81	0.8		
CaO	9.08	9.1	5.75	8.5	7.14	7.11	7	9.1	10.5
SrO	0.5	1	2.9	0.85	1.89	1.88	2.22	1.0	
BaO									
As ₂ O ₃			0.4					0.3	
Sb ₂ O ₃	0.37	0.3							0.3
CeO ₂				0.2	0.2	0.2	0.2		
Y ₂ O ₃									
SnO ₂	0.02	0.05						0.05	
Cl		0.2							
RO/Al ₂ O ₃	0.93	0.93	0.99	0.98	0.98	0.98	0.98	0.93	1.00
CTE (0-300° C., × 10 ⁻⁷ /° C.)	31.9	34.8	33.4	32.8	33.5	32.9	33.4	34.5	34.9
Dens. (g/cm ³)	2.383	2.403	2.405	2.378	2.378	2.374	2.391	2.392	2.378